

Pathways to Impact

The primary lasting impact of this fellowship is expected to be in the use of automated methods in research on animal sounds and interactions. This overlaps to some extent with the “Academic Beneficiaries” but, as [EPSRC guidance](#) states that “*plans for academic impact may be included where this forms part of the critical pathway towards economic and societal impact*,” I briefly recapitulate plans to ensure this impact before describing other avenues:

The decision to focus on songbirds, and in particular on zebra finches, enhances impact because they are an important object of study in zoology. Datasets of zebra finch sound do exist (<http://songbirdscience.com/resources/behavior/global-song-library>, http://web.williams.edu/Biology/Faculty_Staff/hwilliams/ZFsongs/index.html) but they are relatively small, and zebra finches are not well-represented in larger databases such as those of Cornell, Xeno Canto or the Animal Sound Archive. I will record audio in collaboration with the Clayton lab and release it as an open and annotated dataset, which will help to encourage other researchers to perform detailed manual and automatic analyses of zebra finch sound. This data will contain multi-bird recordings not just single sound recordings. Further, I will promote development of algorithms via a public challenge based on this dataset, modelled along the lines of Kaggle machine-learning challenges and/or the IEEE AASP challenge which I recently co-organised. I will make open-source code available so that others can run analysis of their own data. Note that these open initiatives can reach much wider than the “usual suspects” in the academic community: open code and open data can be used by commercial companies and by individual “citizen scientists”, and I will encourage this in my wider public engagement work (see below).

Further plans to enhance impact in the academic sphere include hosting research workshops, and conducting visits to collaborate with other research groups nationally and internationally.

My fellowship also includes explicit plans to enhance impact outside the academic community, building on my own experience as well as that of my host institution to ensure success. In Year 2 I will work with the *cs4fn* team (see *Track Record* below) to develop an edition of their “Audio!” schools magazine. This is a mature and established route to engagement with thousands of schools in the UK and worldwide, and I will use my research and that of my peers to help create an issue with inspiring features about animal sounds and about machine listening. I will also conduct schools talks on these topics. Then in Year 4 I will develop a more involved project, a public engagement exhibit to be taken to schools and municipal centres around the UK. This will build on my experience not only in public engagement but also in organising and performing in technology-driven art projects. It will provide a focal period of public engagement, and will be designed to facilitate media coverage as well as public interest. I will work with the dedicated QMUL Science & Engineering Press Office to make the most of these opportunities to share my enthusiasm with the wider public.

Bird interest groups: I have existing contacts in the British Trust for Ornithology (BTO), and during the fellowship I will also establish contact with the Royal Society for the Protection of Birds (RSPB). The BTO is a UK charity that collects high-quality monitoring data on birds and other wildlife, and thus has more relevance to the scientific aims of this project, whereas the RSPB is more campaign-based but has a higher public profile. I will use these routes to make connections with the strong UK community of “birders” and related interest groups.

Industrial impact: Commercialisation of research output is not explicitly planned as part of this fellowship, because I consider that the best way to achieve lasting impact in this case will be via the approaches described above, helping to make techniques widely available to bioacousticians and others interested in sound analysis. However, my host research group has connections with many partners in the audio industries (Yamaha, the BBC, Novation/Focusrite, the British Library, last.fm, Soundcloud and various smaller enterprises), and where industrial collaboration or spinout is appropriate I will pursue it, in particular during the WP8 follow-on planning. The host institution has an Innovation Unit who will support me in related patenting and licensing, and who also provide funding for exploring spin-out projects.

Track record in impact

I have a diverse track record of public engagement appearances at science festivals, schools talks, and media appearances (see *Track Record* in the Case for Support, and CV). Last year when I led a large team to organise the conference-and-festival *The SuperCollider Symposium*, I led on specific initiatives such as an algorithmic remix competition which gained coverage in various print and radio media and encouraged the public to engage with ideas around automatic music processing.

My host institution has a leading position in the UK for public engagement with computer science, in particular through its *cs4fn* (Computer Science for Fun) initiative. *cs4fn* is a highly-praised global campaign to enthuse both students and others about inter-disciplinary computer science research, consisting of a free magazine sent twice yearly to schools, live interactive shows, and a webzine that gained 14.9 million hits in the last year. This public engagement project is supported by EPSRC and companies such as ARM, Google, and Microsoft. The co-directors of *cs4fn* (Dr Paul Curzon, Prof Peter McOwan) have won numerous awards for teaching excellence.

I have a strong track record in open code, and using this to drive the impact of my work more widely. I implemented much of my PhD work in open-source code, and this code has been taken up and used by others: my entropy estimator has been used in third-party research projects and has been incorporated into a third-party "[information theoretic estimators toolbox](#)"; my work on musical onset detection and timbre features was incorporated into the "[SuperCollider](#)" real-time music synthesis/processing system, used by thousands of musicians and researchers worldwide. I recently won an honourable mention in the Sound Software "Reproducible Research Prizes" for my conference paper in which the code to generate all results was publicly available and could be run by others. I have also led large groups of open-source programmers (such as the SuperCollider team), and contributed to many others in the machine-learning / machine-listening community (eg the "[MPTK](#)" sparse representations toolkit). My host research group also has a strong record of making its research publicly available through software. For example, the C4DM's Sonic Visualiser software is used by thousands worldwide, and various other research groups in the field have developed plugins for it. The C4DM's work on Linked Data has been taken up by institutions such as the BBC and used throughout their webpages.

I also have experience in open data. Recently I co-organised a public evaluation challenge on behalf of the IEEE AASP (Acoustic and Audio Signal Processing) subcommittee. We challenged research teams worldwide to develop algorithms for the detection and classification of audio scenes and events. This was a great success with many international submissions, and won the prize for the best conference submission in the Sound Software "Reproducible Research Prizes".

Resources required

The resources I have allocated specifically for public engagement activities are:

- Produce Audio magazine: **£5,000**
- Within-UK travel, for schools talks: $\text{£}120 * 10 = \text{£}1,200$
- Public engagement exhibit: embedded computer devices ($\text{£}150 * 8$): **£1,200**
- Public engagement exhibit: peripheral hardware: **£1,000**
- Public engagement exhibit: promotional materials: **£500**
- Within-UK travel, for exhibit tour (science fairs, civic centres etc, $\text{£}250 * 12$): **£3,000**

More detail on these is given in the *Justification of Resources* document. I have not requested funding for public engagement training, because I have already benefited from training and experience in this area, and indeed was part of the EPSRC's "NOISEmakers" public engagement programme in recent years.